IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Levy
Art Unit: 2624

Application No: 10/774,312
Confirmation No.: 5422

Filed: February 5,2004
VIA ELECTRONIC FILING

For: WATERMARKING SYSTEMS AND METHODS

Examiner: K. Fujita

Date: November 4, 2008

APPEAL BRIEF

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Sir:

This Appeal Brief is responsive to the *Notice of Appeal* filed August 4, 2008, and the *Notice of Panel Decision* dated October 24, 2008.

Please charge the fee for the brief to deposit account 50-1071.

I. REAL PARTY IN INTEREST

The real party in interest is Digimarc Corporation of Beaverton, Oregon.

II. RELATED APPEALS AND INTERFERENCES

None.

III. STATUS OF CLAIMS

Claims 1-5 and 8 are finally rejected and appealed. Claim 6 is allowed.

IV. STATUS OF AMENDMENTS

All prior amendments have been entered.

A new amendment canceling claim 9 is submitted herewith.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The claimed technology relates to steganographic digital watermarking, and more particularly concerns arrangements for making certain digital watermark signals resistant to attack.

Steganographic digital watermarking is the science of encoding plural-bit data (e.g., a message) in a content object (e.g., an image or video), in such a manner that the data is essentially hidden from human perception, yet can be recovered by computer analysis.[1]

One problem that arises in many watermarking contexts is that of object corruption. If the object is reproduced, or distorted, in some manner such that the content presented for watermark decoding is not identical to the object as originally watermarked, then the decoding process may be unable to recognize the embedded watermark. To deal with such problems, the watermark can convey a reference signal. The reference signal is of such a character as to permit its detection even in the presence of relatively severe distortion. Once found, the attributes of the distorted reference signal can be used to quantify the content's distortion. Watermark decoding can then proceed – informed by information about the particular distortion present.[2]

The assignee's patents 6,408,082 and 6,614,914 detail certain reference signals or features that are added to the watermark, permitting watermark decoding even in the presence of distortion. In some image watermarking embodiments, the reference features (collectively the "template") comprise a constellation of quasi-impulse functions in the Fourier magnitude domain, each with pseudorandom phase. To detect and quantify the distortion, the watermark decoder converts the watermarked image to the Fourier magnitude domain and then performs a log polar resampling of the Fourier magnitude image. A generalized matched filter correlates the known reference features with the re-sampled watermarked signal to find the rotation and scale parameters providing the highest correlation. The watermark decoder performs additional correlation operations between the phase information of the known reference features and the watermarked signal to determine translation parameters, which identify the origin of the

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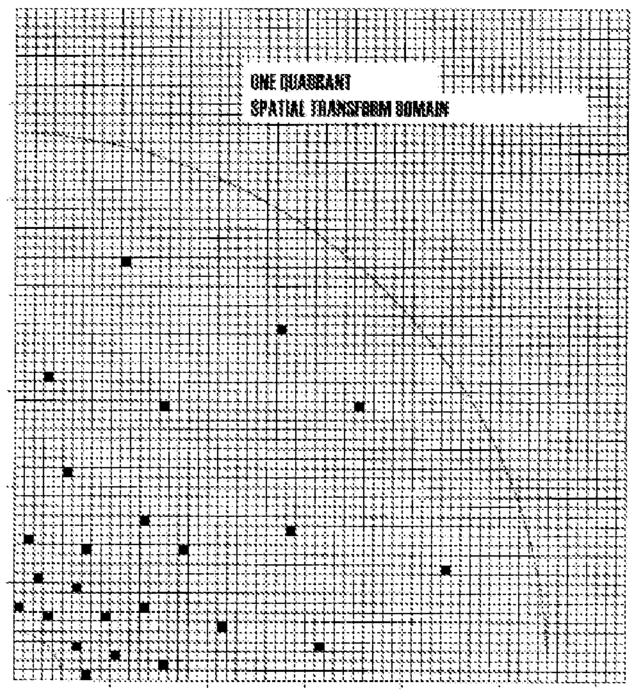
1 Specification, page 1, lines 12-14.

2 Specification, page 2, lines 13-21.

watermark message signal. Having determined the rotation, scale and translation of the watermark signal, the watermark reader can, e.g., adjust the image data to compensate for these distortions, and then proceed to extract the watermark message signal.[3]

A representative template signal is illustrated in incorporated-by-reference patent 6,408,082,[4] by its frequency domain representation, as follows:

FIG. 3



Sometimes an attacker wishes to prevent successful decoding of the watermark, e.g., where the watermark is used in an anti-piracy application. One attack is to average several different watermarked content objects (e.g., images). When averaged, the content itself becomes uncorrelated noise. But the constellation of reference features (quasi-impulse functions in the Fourier magnitude domain, as shown above), which are common across all watermarked images, tend to reinforce each other through such averaging operation, making it possible to identify these reference features and target them for removal.[5]

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3 Specification, page 2, line 22 – page 3, line 6.
4 Specification, page 3, line 16; page 11, lines 13-15.
5 Specification, page 3, lines 14-19.

Independent claim 1 is a Jepson claim directed to methods for making these reference features resistant to attack. In the preamble the claim recites encoding one or more content objects with a steganographic digital watermark – including embedding a collection of features that can be used to facilitate computation of geometrical distortion (including rotation) of the object after encoding.[6]

The "improvement" of the Jepson claim is phrased as a § 112, ¶ 6 "step plus function," namely, a "step for making the collection of features resistant to attack."

There are several "acts" detailed in the specification corresponding to this "step." For example, page 3, lines 21-22, explains that instead of simply adding the constellation of reference features to watermarked content, the constellation can be added to some content, and subtracted from other content. If such content is averaged together, the reference features no longer reinforce; rather, they cancel. (The preferred decoder, detailed in incorporated-by-reference patents 6,408,082 and 6,614,914,[7] is indifferent to whether the reference features are added or subtracted.)

A second act in support of the claimed "step plus function" is detailed at page 2, lines 23-25. Instead of adding the same constellation of reference features to all content, the template is varied between images. For example, it can be rotated differently in different images. Or its phase can be shifted differently in different images. (The preferred decoder can decode the watermark correctly despite such operations.) Again, such acts cause the reference features not to reinforce when content is averaged.

A third act in support of the claimed "step plus function" is detailed at page 2, lines 29-30. In this arrangement, the template is scaled slightly differently in different images – again, preventing it from becoming evident when several watermarked images are summed. (The preferred decoder is robust to scaling.)

While averaging several different content objects to discern a common watermark is one form of attack, another attack involves just a single content object – in which the watermark has

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6 Specification, page 2, line 13 – page 3, line 6.

7 Specification, page 2, line 22; page 11, lines 13-15.

been encoded repeatedly.[8] Again, different portions of the single watermarked object can be averaged together to discern the common watermark.

To redress this attack, a fourth act in support of the claimed "step plus function" of claim 1 is detailed at page 4, lines 3-5. In this arrangement, the reference features do not manifest themselves in the Fourier magnitude domain, but rather in an alternate domain to which an attacker may not turn. A fifth act is related: the template may be keyed, using an invariant keying method that doesn't require additional search over different scale and rotation values to locate.[9]

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1, 5 and 8 are rejected as anticipated by Hayashi (US 20010055390). (Claim 9 was similarly rejected, but has been canceled by the accompanying Amendment.)

Claim 2 is rejected as obvious over Hayashi in view of Macy (6,707,926).

Claim 3 is rejected as obvious over Hayashi in view of Rhoads (6,266,430).

Claim 4 is rejected as obvious over Hayashi in view of Jones (6,792,130).

VII. ARGUMENT

1. Hayashi (US 20010055390)

Like the present technology Hayashi concerns digital watermarking, in which a watermark includes registration signals allowing geometric transformations of the encoded host signal to be identified - permitting recovery of the watermark notwithstanding such transformations. However, Hayashi does not teach how these registration signals may be made resistant to attack.

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8 Specification, page 4, lines 1-3.
9 Specification, page 4, lines 5-7.

2. <u>Claim 1 (§102 Hayashi)</u>

Claim 1 reads as follows:

> *1. In a method that includes encoding one or more content objects with a steganographic digital watermark, the encoding including embedding a collection of features that can be used to facilitate computation of geometrical distortion of the object after encoding, the geometric distortion including rotation, an improvement including <u>step for making the collection of features resistant to attack</u>.*

(Emphasis added.)

The rejection fails for two reasons.

First, Hayashi does not teach a method for making his collection of features (termed registration signals) <u>resistant to attack</u>. The Office cites paragraph [0005] for such teaching.[10] However, this paragraph simply introduces the concept of an added signal (which he terms the registration signal) that is used to determine geometric distortion to which an encoded image has been subjected.

This teaching corresponds to the *preamble* of claim 1 – not the *improvement* clause, as asserted by the Office.

Secondly, the rejection fails because the Office has not applied the *Donaldson* analysis required when examining a claim phrased in step-plus-function format. See *In re Donaldson*, 16 F.3d 1189, 29 USPQ2d 1845 (Fed Cir, 1994). *See also: Examination Guidelines For Claims Reciting A Means or Step Plus Function Limitation In Accordance With 35 U.S.C. 112, 6th Paragraph,* 1162 O.G. 59 (May 17, 1994).

Until the Office makes a *prima facie* showing under *Donaldson,* Appellants understand they have no burden to further respond.

Because the Office has mis-read Hayashi, and has failed to apply the proper analysis under § 112, ¶ 6, the rejection of claim 1 should be reversed.

3. <u>Claim 5 (§102 Hayashi)</u>

Claim 5 is patentable for its dependence on claim 1, and is also separately patentable. The claim reads:

> *5. The method of claim 1 wherein said step includes obscuring said collection of features by designing same to become apparent only in an alternate domain.*

The Office cites Hayashi at Fig. 4, item 402 as anticipatory. However, item 402 shows a Fourier transforming unit.

Construed with reference to the specification, "*obscuring said collection of features by designing same to become apparent only in an alternate domain*" means that the features are not in the domain where they would be evident, i.e., not in the Fourier domain taught by the prior art. (See the discussion of prior art at page 2, lines 24-25, of the present specification.)

The cited teaching of Hayashi draws from the prior art cited in Appellant's specification. Presentation of Hayashi's registration signals in the Fourier domain would not be "obscured" – they would be where the prior art teaches they will be found.

The anticipation rejection of dependent claim 5 should thus be reversed.

4. <u>Claim 8 (§102 Hayashi)</u>

The rejection of dependent claim 8 stands or falls with the rejection of claim 1, from which it depends.

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[10] Final Rejection, page 4, line 8.

5. Claim 2 (§103 Hayashi + Macy)

Claim 2 is allowable for its dependence from claim 1, and is also independently allowable. The claim reads as follows:

> *2. The method of claim 1 wherein said step includes adding said collection of features in some of said objects, and subtracting said collection of features from other of said objects.*

The Office contends that Macy teaches such limitation. However, it does not.

Recall that the "collection of features" required by the claim serves to facilitate computation of geometrical distortion – including rotation – of the object after encoding (per claim 1).

Macy's arrangement is unsuitable for this purpose. His technology can detect only scaling and shifting[11] – not rotation.

Moreover, Macy embeds his signal in the spatial domain.[12] In contrast, Hayashi embeds his signal in the frequency domain.[13] Macy's arrangement can not be substituted into Hayashi because of this basic difference between the systems.[14]

In view of the foregoing, claim 2 is properly patentable over the art.

6. Claim 3 (§103 Hayashi & Rhoads)

Claim 3 is allowable for its dependence from claim 1, and is also independently patentable. The claim reads:

> *3. The method of claim 1 wherein said step includes embedding said collection of features at a first scale in a first object, and embedding said collection of features at a second, different scale in a second object.*

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11 *See, e.g.,* Macy at col. 5, lines 34-37.

12 *See, e.g.,* Macy at col. 5, lines 34-35; col. 6, line 15.

13 *See, e.g.,* Hayashi abstract.

14 In connection with this point, note patent 6,792,130 to Jones (made of record by the Office in connection with claim 4). In its *Background* discussion the Jones patent explains "A basic distinction between various methods is whether the watermark is applied in the spatial domain or the frequency domain." (Col. 1, lines 39-41.)

The Office cites Rhoads at Fig. 6, numerals 210 and 218, for such teaching. Rhoads teaches *magnitude scaling*[15] of the watermark signal (i.e., the watermark signals applied to different pixels vary in magnitude). He does this so the added watermark signal is better masked by the host content.

Again, recall that the presently-claimed invention concerns making the collection of features resistant to attack. By scaling the collection of features differently in different content objects, the specification explains that an attacker cannot average plural watermarked objects to discern the embedded features.[16]

This claim purpose requires *geometric* scaling. By sizing the template (e.g., shown in the figure reproduced above) slightly larger or smaller, the impulse functions do not appear in consistent positions. So when averaged, they are lost rather than reinforce.

Rhoads teaches only scaling in magnitude. Even if some features are larger in magnitude than others, they still reinforce if averaged across plural items of content.

Thus, Rhoads' magnitude scaling – if employed in Hayashi – would not yield an arrangement in which the collection of features is resistant to attack, as required by the claim.

In view of the foregoing, claim 3 is properly patentable over the art.

7. <u>Claim 4 (§103 Hayashi + Jones)</u>

The rejection of claim 4 stands or falls with the rejection of claim 1, from which it depends.

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15 *See, e.g.,* Rhoads at col. 16, line 38.

16 *See, e.g.,* specification at page 3, lines 17-30.

VIII. CONCLUSION

The § 102 rejections fail in view of factual mis-understanding of the prior art teachings, and legal error in the applied analysis. The § 103 rejections are similarly flawed. Accordingly, the Board is requested to reverse the rejections of claims 1-5 and 8.

Respectfully submitted,

Date: November 4, 2008

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IX. CLAIMS APPENDIX

1. In a method that includes encoding one or more content objects with a steganographic digital watermark, the encoding including embedding a collection of features that can be used to facilitate computation of geometrical distortion of the object after encoding, the geometric distortion including rotation, an improvement including step for making the collection of features resistant to attack.

2. The method of claim 1 wherein said step includes adding said collection of features in some of said objects, and subtracting said collection of features from other of said objects.

3. The method of claim 1 wherein said step includes embedding said collection of features at a first scale in a first object, and embedding said collection of features at a second, different scale in a second object.

4. The method of claim 1 wherein said step includes embedding said collection of features at a first orientation in a first object, and embedding said collection of features at a second, different orientation in a second object.

5. The method of claim 1 wherein said step includes obscuring said collection of features by designing same to become apparent only in an alternate domain.

6. In a method that includes decoding a steganographic digital watermark from an encoded object, the encoding including a template signal that aids in determining corruption of the object, the corruption including rotation, an improvement comprising step for detecting the template signal without log-polar remapping.

7. (Canceled)

8. An object produced by the process of claim 1.

9. (Canceled)

X. EVIDENCE APPENDIX

None

XI. RELATED PROCEEDINGS APPENDIX

None